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HOUSEHOLD TECHNOLOGY ACCEPTANCE HETEROGENEITY IN COMPUTER ADOPTION

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Abstract: *Technology policy analysis and implementation relies on knowledge and understanding of the "adoption gap" in information technologies among different groups of consumers. Factors that explain the residential "digital divide" also need to be identified and quantified. Through the application of survey data we provide an enhanced understanding of the key factors involved in the choice of residential computer adoption. These choices are analysed using a discrete choice model that reveals that socio-demographic factors strongly influence the adoption of the residential computer. Moreover, we apply the basic findings of the Technology Adoption Model (TAM) into the discrete choice framework heteroscedastically to deepen our understanding of why some households choose not to have computers; above and beyond what may be explained by socio-demography alone. Generally, we find that computer adoption is sensitive to household digital division measures and that the model fit improves with the heteroscedastic addition of the TAM factors. These findings are important for market planners and policymakers who wish to understand and quantify the impact of these factors on the digital divide across different household types, as defined by the TAM model.*

Introduction

The digital divide refers to the gap in Information and Communication Technology (ICT) adoption between members of the same social system. The analysis of this division is becoming increasingly important for various stakeholders. For market orientated planners, like telecoms professionals, the need is to understand how ICT markets will change given specific and evolving market stimuli; and the extent to which product and service provision meets expected demand. For policy orientated organisations, for example governments, the problem of the digital divide exacerbates real social division as those members of the social system without reliable ICT services are excluded from the benefits that these technologies provide (Robertson, Soopramanien and Fildes, forthcoming-a; forthcoming-b).

In the UK (ICT Consumer Research, 2005) and the United States (Chaudhuri, Flamm and Horrigon, 2006) the problem of the digital divide remains firmly in place with little direct policy focussing on its elimination. The evidence describes a typical pattern; those caught on the wrong side of the digital divide generally tend to be poorer and less well educated. British policy, much like policy in the US, principally relies on market forces to deliver ICT resources to households. That is, commercial enterprise is relied upon to supply technology at the right price, from this point it becomes a matter of consumers' acceptance of the technology, for a given price, as to whether the technology becomes absorbed completely throughout the social system. Since markets can fail consumers (Arrow, 1962) and therefore economies (Stiglitz, 1998), clear and directed monitoring of ICT markets is necessary. The need for monitoring is highlighted in recent developments at the World Summit on the Information Society in Tunis 2005. Here, the International Telecommunications Union (ITU) declared its initiative on core ICT indicators (ITU, 2005). This paper provides advice to countries on how to collect ICT data that will develop market research resources to practitioners to provide support from which knowledge based decision making may be accomplished. The overall thrust of the initiative is to provide information to policy planners that will clarify existing and future developments in ICT adoption and penetration. Importantly, the information provided by data collections would be strongly influential in developing national ICT policies that minimise the risk of social exclusion.

Before policy regarding the digital divide can be implemented the extent to which it exists, and why it exists, must be addressed (Robertson et al, forthcoming-a). Although a number of statistical modelling papers have been published that highlight and quantify the factors that underpin the digital divide (Robertson et al, forthcoming-a; Chauduri et al, 2006, Choudrie and Dwivedi,2005; 2006) much of the focus from papers that employ choice based models has been on the internet medium as the choice facing the consumer. This paper contributes to the debate on the digital divide by showing that an important choice facing the household consumer is the computer, not the internet *per se*. We show that via the application of household survey data that a critical barrier to internet adoption can be the cost of purchasing a computer. In fact we provide a model that suggests that non-computer owning households fall into distinct groups, the voluntary and involuntary non-adopters. The voluntary non-adopters tend to have very low valuations regarding the role of ICTs in their lives. This can occur for a number of reasons that can include a lack of understanding of how ICTs generally improve living standards. Contrarily, some households that have very low technology adoption thresholds have adopted computer technology which suggests that present digital divisions may decline further if the conditions of use are facilitated by policy. For involuntary non-adopters it is more likely the financial hurdle of computer purchase that inhibits adoption (Robertson et al, forthcoming-b). The final contribution of this paper is to show that residential ICT adoption, as measured by computer adoption, can be modelled holistically using both household socio-demographics (presence of children, household educational attainment and household disposable income) but importantly also by applying a technology acceptance belief structure that social psychology prescribes. Previously estimated econometric models apply only socio-demographics to model the household ICT choice. We show that technology acceptance perceptions usefulness, ease of use and enjoyment can influence household computer choice also. The econometric model we estimate provides evidence on why some very poor households own computers when many do not. We show that this can occur because less well off individuals gain considerable utility from computer ownership, something that the technology acceptance model predicts. One benefit of this approach is that it provides policy makers with a segmentation model that highlights the importance of socio-demographic profiles in assessing the digital divide, but also the importance of the psychological parameters underlying technology choice that can affect the outcome of whether a computer is purchased. The approach we develop shows that even poor households with low levels of educational attainment may adopt ICTs providing their perceptions towards this technology can be influenced or providing the financial barrier to adoption is removed.

This paper is organised as follows. We provide a literature review and conceptualization of our research that focuses on the strongest factors found to influence the digital divide. It also focuses on the techniques that have been applied to measure the impact of the factors on residential ICT choice. The next section introduces our conceptual computer choice model and this leads to a section that describes the data used to estimate the heterogeneous probit. The probit results are then presented

which leads to the final section, conclusions and suggestions for further research, which provides discussion of the findings of this paper and recommendations for policy based on them.

Literature Review and Conceptualization of Research

To understand technology markets more fully it is important to address consumer segmentation issues (Robertson et al, forthcoming-a, forthcoming-b). Rogers (1995) proposed that the market for new and innovative products is segmented, i.e. specific groups of consumers will adopt the innovation faster than other groups within the same social system. This naturally implies that the probability of adoption varies systematically for each consumer segment. In this sense we may segment the household ICT market into those that have a specific technology and those that do not. Prior research has accomplished this quite successfully. Kridel, Rappoport and Taylor (1999, 2002) show how researchers can apply consumer survey data to assess differential internet adoption patterns. They argue that this type of approach is useful when time series market data provides limited information on why different groups of consumers have different perceptions to the role of information technology in their lives. The authors use a large sample dataset from the US and assess the determinants of internet service choice for high-speed cable modem services among household internet users. Specifically their market orientated model identifies the price of the internet service, income, age, educational attainment, household size and geographic location as factors that differentiate the choice of cable modem services over dial-up services. Evidence in favour of educational attainment and disposable income being digital division factors is strong. Robertson et al (forthcoming-a) found that these factors had a considerable effect on the adoption of residential ICT services, particularly for those households with a degree level education and higher than average disposable income. Chaudhuri et al (2006) also found educational attainment and household income to be important residential internet choice factors. Choudrie and Dwivedi (2005, 2006), in a study of London households in the UK, also highlighted these factors to be important in the choice of whether to adopt broadband services. Kridel et al (1999, 2002) considered the impact of household size on internet adoption and found it positively correlated with the ICT adoption. Robertson et al (forthcoming-a) tested whether the number of adults affected ICT adoption at the household level but concluded that this variable was too highly correlated with household income to be applied reliably. This may imply that earlier results using household size, defined as the number of adults *and* children in the household, as the predictor of ICT choice may be unduly influenced, via collinear effects, by these factors.

Several strands in the literature suggest that technological innovations are usually adopted by a particular group of consumers who are commonly referred to as "technophiles". This implies that assessing the general level of technological adoption by households should provide a useful predictor of the demand for other new technological innovations, such as the internet. In that context, Busselle, Reagan and Pinkleton (1999) and Kridel et al (1999) have analysed the relationship between internet availability and the level of other technologies in the home. Unsurprisingly, the authors find a strong positive correlation between the number of technological devices in the home and internet adoption/usage. Although this finding is fairly obvious (i.e. people that like technology are more likely to adopt more of it!) it highlights the question of what actually drives the underlying psychology of technology adoption. Also, if the underlying process can be modelled whether a metric can be derived from it that could be used in a statistical framework to segment consumers into groups with similar ICT adoptive characteristics (Soopramanien and Robertson, 2007)?

Davis (1989) provided a psychological framework that highlighted key elements of human technology acceptance. Davis, building on the Theory of Reasoned Action (Fishbein and Ajzen, 1975), suggested that the adoption of technology is potentially influenced by the consumers' general acceptance of the technology as a useful communicating and interactive medium. The Technology Acceptance Model (TAM) was first applied to study how employees accepted ICT technologies within a work environment. The TAM literature suggests that when an ICT adoption choice must be made, providing that it is not influenced unduly by peer pressure (e.g. competitive work colleagues' adoption of technology forces personal adoption of ICT to maintain job prospects) then subjects' perceptions toward the technology on its *usefulness* and *ease of use* remain key drivers of the choice. Perceived *usefulness* is described by Davis (1989), as the belief that ICT adoption leads to augmented workplace activity. In this sense a worker may attribute the successful personal assimilation of ICT in work practice to improved promotion/wage prospects. More simply, the perception of *ease of use* is described as the belief that an IS system is effortless in use. The TAM has been successfully modified to enhance our understanding of the psychology of ICT adoption. For instance, Igbaria, Parasuraman, and Baroudi (1996) included the human perception *enjoyment* with the original usefulness and ease of use perceptions highlighted by Davis (1989). In this sense, the perception of enjoyment is defined as the belief that one takes pleasure in using ICT, above and beyond the needs of usefulness. This fuller and more realistic model provided a better fit to the mental model of ICT choice and use than predecessors. Interestingly, Van der Heijden (2004) described how perceived usefulness and enjoyment may be described, respectively, as utilitarian and hedonic

activities. The utilitarian element implies that individuals will adopt and use ICT to increase, say, output performance leading to increased operational efficiency (for example, purchasing travel ticket online, saving a physical journey to the travel agent). In comparison the hedonic component is accomplished simply because the individual enjoys the pastime of using ICT in a particular way (e.g. gaming). Soopramanien and Robertson (2007) applied the TAM factors predictively summarising the three TAM perceptions, ease of use, usefulness and enjoyment into a single variable defined as ICT utility. This metric of technology acceptance, measured through a survey instrument, was then applied into an econometric choice framework that predicts survey respondent association to specific online shopping user groups. The application of TAM in this way intuitively predicted that those respondents with very low technology acceptance thresholds are very much less likely to adopt online shopping as an innovation; even if they had access to computers. Venkatesh and Brown (2001) and Brown and Venkatesh (2005) provided and tested the Model of Adoption of Technology in Households (MATH). A finding from Brown and Venkatesh (2005) indicated that key demographics would take significant roles over the family lifecycle. Relevent to this research, they model computer adoption by capturing attitudinal beliefs (e.g. utility for work or children effects), hedonic outcomes (e.g. enjoyment of use), status gains, word of mouth and/or media effects and control beliefs (e.g. cost and ease of use), but importantly also apply household socio-demographics (age, income, marital status, child age) into the structural model. The authors show that including lifecycle variables in the analysis (they were not analysed in the original MATH model presented by Venkatesh and Brown, 2001) enhances model fit significantly.

The modelling of household technology choice via the application of econometric analyses have specifically focussed on the internet choice in the household and have been undertaken on several dimensions. Kridel et al (1999) estimated a binary (two-way) high-speed internet choice model where they use survey data captured from individuals that have residential internet access. Underlying this choice structure is the concept of consumer utility that assumes that consumers will always maximize product specific utility subject to constraints, such as product price and disposable income. This utility maximization process is captured from data using a regression model for categorical variables as shown by equation 1.

$$Prob(High\text{-}speed\ Access|\mathbf{x}_i) = G(\mathbf{x}_i\boldsymbol{\beta}) \quad (1)$$

where $\boldsymbol{\beta}$ is a vector of parameters to be estimated from the data that relate to geographic specific price effects, age, gender, ethnicity, employment status, income and educational attainment. *G(.)* can represent a variety of functional forms although the authors apply the logistic function to estimate the parameters. A limitation of this modelling approach is that the analysis is confined to households that already have internet services and therefore it cannot be used in policy analyses that seek to address the digital divide.

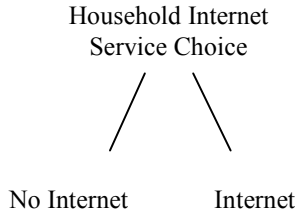

Figure 1. The household internet choice

Chaudhuri et al (2006) presented a unique paper that addressed directly residential internet model with a greater focus on the digital divide. It showed how the determinants of internet access may be assessed using a binary choice framework. The market structure they sought information on is presented in figure 1. Using survey data from United States households, the authors estimated the following model:

$$Prob(Home\ Access|\mathbf{x}_i) = G(\mathbf{x}_i\boldsymbol{\beta}) \quad (2)$$

where $\boldsymbol{\beta}$ is a vector of parameters that relate to geographic specific price effects, age, gender, ethnicity, employment status, income and educational attainment. As with Kridel et al (1999), they chose a simple binary logit framework to estimate its parameters. Their research extends the work of Kridel et al [1999] by assessing residential ICT choice across all households, not simply focusing on those that already use the internet.

Although Venkatesh and Brown (2001) and Brown and Venkatesh (2005) provide structural models of household computer adoption, it was alluded to in the introduction that very little choice based *econometric* research has been undertaken that focuses specifically on household computer choice. We posit, that at the household level, that it is computer adoption that is critical to residential use of internet as few other technologies (e.g. PDA or mobile phones) allow full use of this information service. To date, very little evidence has been provided to suggest that these alternative internet portals are being used by

households to compensate for the lack of computer access within their residences. This point indicates that unless alternative or new technologies provide internet access that are accepted and used then it remains to be the computer as the main source of household internet access. It is important to note that computers have multiple roles within the household (e.g. word processing, monitoring of household finances and gaming) and that internet is only one of them, albeit an important one. We find from our survey data (see Data section below for description) that 9% of computer owning households in the UK *did not* have residential internet access of any kind, this finding is similarly found in surveys conducted for the UK telecoms regulatory body, Ofcom. This final point may have important ramifications for the modelling of ICT markets. Since previous econometric papers (i.e. Kridel et al (1999), Chaudhuri et al (2006) and Robertson et al, forthcoming-a) model household income, educational attainment and household size as determinants of home *internet* access, it is more likely that the coefficients they estimate are estimates for the computer related factor choice; as this is the real *cost/skill/need*s hurdle of internet access. Estimates that have been provided based on internet choice may be potentially biased however, because of the 9% of respondents that are not measured as computer owning households with no internet access. Importantly, we find from our data that these computer owning, non-internet households are characteristically different from non-computer owning households. This would suggest that internet choice models should focus on *computer owning households only* and that the residential computer choice should be treated as a separate problem. We contribute directly to this debate by providing a household ICT choice based model that focuses specifically on computer choice. How this is accomplished is discussed in the next section.

Research Methodology

In this paper, we estimate the two-way heterogeneous probit model shown in Figure 2. It is an extension of the binary choice models provided by Kridel et al. (1999) and Chaudhuri et al. (2006) although we estimate computer rather than internet choice. To further contribute to ICT modelling methodology, and to enlighten policy, we extend the model to incorporate the TAM framework that acts as a heterogeneous layer, often described as a random effect (Solgaard et al, 2005). Heterogeneous models offer considerable flexibility to the researcher in that the richness of the real world may be incorporated into the statistical framework to offer more precise parameter estimates. Probit models have been applied in a number of choice applications. Gill (2005) applied heteroscedastic probit of the type we apply to understand voters' uncertainty as they assessed candidates' policy positions in US elections. Gill (2005) found that the application of '*dispersion parameters'* to the problem measuring voter choice improved model fit significantly.

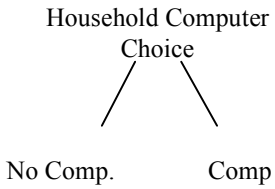

Figure 2. The household computer choice

We reapply the heterogeneous probit to assess residential computer choice using a selection of choice factors that are derived from the literature. The socio-demographics drivers of computer choice we apply are the presence of children, educational attainment and household disposable income. As mentioned earlier, a significant contribution of this paper is the inclusion of the TAM framework as a heterogeneous layer. To understand why the TAM variable should have a heterogeneous effect within the computer choice framework we must address some conceptual issues. Household computer choice is likely to be affected by the choice factor variables that can be measured by the researcher, e.g. via surveys. Despite our knowledge on this, there are also likely to be factors that usually lie outside of the researcher's knowledge domain that effect taste variations (Ben-Akiva and Lerman, 1985). This would usually result in heteroscedasticity in the residuals of the model (Brownstone and Train, 1998) that could lead to leverage effects on the parameters and standard error estimates (i.e. they are biased). To overcome this, we would apply variables to the model that may compensate for absence affects.

As described during the literature review, the TAM literature is quite prescriptive on how humans perceive technology and how this information can lead to predictions on how technology may be adopted/used. Brown and Venkatesh (2005) also highlighted that the incorporation of both belief structure and socio-demographics yielded better model fit than standard

belief structures alone. These findings may potentially also have ramifications for residential computer choice that is estimated using descrete choice methods, and this is the hypothesis we seek information on. Household ICT adoption propensities are idiosyncratic by nature. Although we may say, on average, that households with high levels of educational attainment and income are more likely to adopt technologies, on a national scale we will inevitably find some that *do not*. Empirical evidence on this issue was provided by Choudrie and Dwivedi (2005) who highlight (pp. 99) that a considerable number of non-adopters in their sample also belonged to higher income groups. Traditional econometric choice models that only apply socio-demographics do not account for this type of non-adopter. We posit that the TAM model will be usefully applied heteroscedastically to explain part of this heterogeneity. It is logical to assume that wealthy non-adopters may exist because they do not value computers in their lives. It is possible that part of this low valuation exists because they do not find computers useful, or they find them to be too complex to use, or simply because they do not enjoy using them. Conversly to the Venkatesh and Brown (2001) paper that estimated the MATH model based on belief structure only, prior choice modelling research that estimates ICT choice structures has not accounted for the heterogeneity of the belief structure. This would suggest that parameter estimates may contain some bias due to the leverage effects that heteroscedasticity can cause. We suggest the TAM belief structure to model household heterogeneity as a logical extension to our understanding and measurement of residential ICT adoption, specifically computer choice. As our model predicts, for households of a given socio-demographic profile (e.g. no children, highly educated and average income) the probability of computer adoption will systematically vary between those households that have low value perceptions towards computers when compared to those with higher perceptions. This is a finding that we find appealing as it more holistic than previously published choice based approaches, incorporating both socio-divide factors and human belief structures.

We estimate the probability of household computer adoption given the factor effects, x_n, using equation 3:

$$Prob(Home\,Computer \mid x_n, TAM) = \Phi\left(\frac{x\beta}{e^{\alpha TAM}}\right) \qquad (3)$$

In this heterogeneous probit model Φ is the standard notation for the cumulative standard normal distribution. $e^{\alpha TAM}$ defines the control for heteroscedasticity with α being the coefficient of dispersion of TAM. Interestingly, in the standard binary probit the denominator is constant for all *n* households (i.e. σ^2). Within the heteroscedastic framework this restriction is relaxed so that $\sigma^2 = e^{\alpha TAM}$ which in this case may take 4 levels, each level defining a different set of computer adoption probabilities for a given set of *x*.

Equation (3) is estimated using a log likelihood framework. The benefit of log likelihood estimation is that any relaxation of underlying model assumptions (i.e. heteroscedastic versus standard probit) can be statistically tested thereby fortifying underlying theoretical positions. In this case we need to test whether the TAM framework can be included into the theoretical model of residential ICT choice. The restriction here is that $\alpha = 0$ (i.e. the model is a standard probit) versus the alternative that TAM does reduce heteroscedastic tendencies within the residential computer choice setting. In the event of $\alpha = 0$ then $e^{\alpha TAM} = 1$ which is the standard deviation of the standard normal distribution. To test the hypothesis that $\alpha = 0$ we apply a likelihood ratio (LR) test of the restricted (i.e. the standard probit) against the unrestricted heteroscedastic model. In this case only one restriction applies implying that the LR statistic is distributed as $\chi^2_{(1)}$.

The Data

The data we employ was collected during the middle part of 2003 and during the same period of 2005. The Oxford Internet Institute (OXis, 2005) reported that between their survey points taken during 2003 and 2005, that internet access had reached a plateau in the UK. From this we assume little change to residential computer penetration in our data. Using this assumption we pool household computer choice data from both survey periods. The survey was administered via post to approximately 5,000 households during each year in the areas of Lancaster in the northwest of England and of Brighton and Hove in the southeast of England. A further smaller sample was collected from around the UK. Households were selected using the British electoral register,supplied by *UKinfo*. Using the UKinfo database we were able to select respondents on a street by street basis within postcode districts. For example, in the regions we analysed the entirety of the electoral register was gathered. From this we selected approximately 1 in 10 households. Only one survey was sent to each household (i.e. duplicate addresses were removed) and to encourage a good response, respondents were entered into a prize draw. The envelope that the respondent received was personalised and used the university logo. It contained a survey booklet, introductory letter on university headed paper, a pen and a business response envelope. The survey produced a similar response rate in each year of 18% for Lancaster and 10% for Brighton. In total, 1402 complete responses were used in this

analysis. The survey was extensive, asking respondents 73 questions (see Appendix A for the 2005 survey form) relating to computer and internet adoption, ISP subscription price and service type, perceptions toward ICTs, online shopping behaviour, and socio-demographic details. Self-administered surveys need to be created so that leading or ambiguous questioning is minimised Moritz (2001). Similarly to Dwivedi, Choudrie and Brinkman (2006) and Choudrie and Dwivedi (2005, 2006), during drafting phases individuals of varying socio-economic backgrounds, including academic staff familiar with surveying methods, were asked to complete the survey with the view of finding questions that they perceived as ambiguous, having an incomplete array of potential responses, poorly positioned, leading (driving answers that may not actually be correct) or too complex, requiring simplification or more explanation. This process was repeated three times until all comments made had been resolved. The surveys were designed and managed using a professional survey package called SNAP Professional. Non-response bias was encountered that may be a result of our use of the electoral register. Readers should be aware that the complete register does not account for all UK residents for two reasons. Firstly, UK electors may opt to have their name removed from the electronic database; secondly, some UK residents may choose not to register to vote. If the profiles of either absent group vary from those on the register then we may encounter non-response bias. In our case, our data over-samples households from well educated, and higher than average computer adoptive backgrounds. For example, the 2003 survey measured computer adoption to be 77.6% at a time when Ofcom (the UKs Telecoms market regulator) reported from its national survey that 58% of households in the UK owned computers. Interestingly, Choudrie and Dwivedi (2005) in a study of Hillingdon, London measured PC adoption to be 76.2% during 2003 which is very closely aligned to our own estimate. Some bias in in age and gender was also encountered. All biasing effects that we measure were compensated for using a weighting process. In this context we rim weighted the data to national averages supplied by the Office of National Statistics and the Department for Education, to compensate for key socio-demographic variables (age, educational attainment, and gender) and also for computer penetration (Barnett, 1991; Elliot, 1995). All statistical work, including econometric modelling, was carried out using Intercooled STATA 9.

Within the survey that generated the data respondents were asked to rate statements relating to how they perceive computers (see Q27, Appendix A) on a five point Likert scale ranging from *Strongly Disagree* to *Strongly Agree*. In line with Teo et al (1998) we collected data on three perceptions, i.e. computer ease of use, computer usefulness and computer enjoyment. Soopramanien et al (2007) used this data to segment consumers into ICT utility groups; this is the process we follow here also. We apply a K-mean cluster programme based on squared Euclidian distance to segment our survey into groups with differential ICT adoption propensities. Having applied this technique to 2, 3, 4, and 5 clusters we find that clustering at level 4 provides best classification, based on comparing each cluster type to actual computer adoption. The clusters were then ordered 1 to 4 within a single variable. It is this variable we define as TAM that we apply to compensate for heteroscedasticity within the probit choice framework. The computer adoption levels for each cluster within TAM were as follows: cluster 1 = 43%, cluster 2 = 74%, cluster 3 = 82% and cluster 4 = 92%.

Results

We described earlier that the dependent variable in the model is the probability that a household makes one of two choices, that is, whether to adopt a computer into the household. All choice factors, i.e. presence of children, educational attainment and household disposable income, are entered as categorical variables. For example, the impact of higher schooling on computer choice is 1 if the household is found to have at least one person educated to this level, and 0 otherwise. Each set of categorical variables has a reference category and the resulting coefficients measure the effect of the non-reference categories relative to the reference category.

To validate the use of TAM that we posit controls for household ICT choice heterogeneity, two measures are applied to determine whether the more complex heteroscedastic model out performs the standard binary probit model. The first is the likelihood ratio test described above. This is shown at the bottom of table 1. Recall that the null for this test is of no heteroscedasticity present in the model i.e. TAM is ineffectual for modelling household heterogeneity. In this case the null is rejected at the 5% level. A further test is to measure and compare correctly predicted outcomes for the heteroscedastic against its non-heteroscedastic probit counterpart (as per Solgaard and Hansen, 2003). The heteroscedastic computer choice model successfully predicts in 75% of cases versus 72% in the standard probit. Both measures imply that the inclusion of TAM factors to capture heterogeneity amongst ICT adopters is successful. It remains now to describe policy parameter outcomes of the most successful model. These are provided in table 1.

The model results are presented as marginal effects. In this way we are able to determine how the probability of computer adoption changes when, say, a categorical variable becomes 1 from 0. The presence of children is found to exert a positive

influence on residential computer choice. On average the adoption propensity increases by approximately 10% over households that do not have children. This evidence is similar in outlook to the internet choice outcomes provided by Robertson et al (forthcoming) and Kraut et al (1996) i.e. the presence of children increases the propensity to adopt internet generally. In line with other research (Robertson et al (forthcoming-a), Chauduri et al (2006), Kridel et al (2002)) we find that residential computer adoption is strongly affected by educational attainment. *Ceteris parabus*, households with degree level education are, on average, almost 29% more likely to adopt computers when compared to households without any formal education. As the level of education falls, so do the marginal effects. For those households with professional level education or a general higher schooling the affect is similar at approximately 17%. Those households stating they had '*other*' schooling were on average 14% more likely to own a computer than those households without a formal education. Those households with only level 2 schooling were not statistically different from those without any at all. These are worrisome findings as the Department for Education and Skills (DfES) in the UK estimate that 35% of individuals in UK fall into this non-adopting category.

Strong support is found that residential computer adoption is heavily influenced by income factors. Households earning £25,000 or above are, on average, 30% more likely to own a computer than a household earning less than £10,000 per annum. It is interesting to note that as income rises towards £25,000 that the likelihood of computer ownership increases systematically. This is clear evidence that the household computer element of the digital divide is strongly influenced by income factors. The Office of National Statistics reports that approximately 35% of householders fall below the £15,000 income threshold in the UK.

Table 1: Heteroscedastic Probit Marginal Effects		
	Marginal Effect	*Robust Significance Level*
Presence of Children	0.1013	0.009
University Education e.g. Bachelors, Masters, MBA or Ph.D.	0.2859	0.000
Professional Qualifications (e.g. accountancy, nursing)	0.1716	0.001
General Higher Schooling A'Level, AS'Level, HNC etc	0.1676	0.002
Other Qualification	0.1373	0.029
General Normal Schooling O'Level, GCSE etc	0.0501	0.436
Household Income		
£10,000 to £14,999	0.0997	0.042
£15,000 to £19,999	0.1570	0.001
£20,000 to £24,999	0.1906	0.000
£25,000 and above	0.2986	0.000
TAM heterogeneous layer	0.0412	0.029
Liklihood Ratio Test (α=0) = 5.16 ~ $\chi^2_{(1)}$ Prob = 0.0231		

The TAM marginal effect captures heterogeneity among survey respondents well. The marginal effect is statistically significant at the 5% level, as is shown in table 1. The marginal effect value of 0.04 suggests that ICT adoption propensity increases by approximately 4% for each incremental increase in the TAM measure, 1 through 4, regardless of which demographic profile is under analysis. This is a logical and intuitive finding that strengthens the contribution that we have provided in this paper.

Conclusions and Suggestions for Further Research

If the computer and the internet are to become ubiquitous communication devices, it is important to develop a framework of measuring tools that can be applied by researchers and policymakers alike to ensure policy clearly identifies those in most

need of policy support. This paper builds on the work of Robertson et al (forthcoming-a), Kridel et al. (1999) and Chauduri et al. (2006) by quantifying the determinants of the digital divide and how they impact in the UK using survey based data to estimate discrete choice. The extension of household computer choice that this paper provides is an important contribution to the debate on digital division as it provides first known estimates of the effect of presence of children, educational attainment and household income and how they relate to computer choice in the United Kingdom. We find it acceptable to believe that the first barrier to adoption of internet is the cost of the computer. Although less expensive when compared in previous times, our model predicts that household income is of critical importance to this particular technology. Prior research (i.e. Kridel et al (1999), Chaudhuri et al (2006) and Robertson et al, forthcoming-a) that looks at income effect relative to internet adoption is likely to be estimating the computer element of the choice, not internet adoption specifically. In our 2005 sample, we find that 9% of computer owning households *did not* have residential internet access of any kind. Importantly also, we find that the income distribution of households that own a computer but do not have it connected to the internet is lower than for households that do have internet services. Importantly also, those households without a computer have a lower income distribution that either of the computer owning groups. This would suggest that if we are to model residential ICT choice correctly then we should first measure computer choice using the usual digital divide factors. The next stage would be to assess how these factors then influence internet choice among computer owning households. Interestingly we estimated logit models that highlight that socio-demographic effects wash out between the computer and internet choice stages. We find only income to be statistically significant in the internet choice among computer owning households; but with much less impact than for the computer choice model; as evidenced by very small, although statistically significant, marginal effects.

This paper contributes to knowledge by developing a theoretical framework of residential ICT adoption that applies both standard digital divide factors (i.e. socio-demographics) and psychological technology acceptance parameters into a single household heteroscedastic probit choice structure. The application of the TAM variable was found to be statistically significant and it was also shown to improve predictive outcomes when compared to the standard probit analogue. The successful application of this model deepens our understanding of consumer segmentation within technology markets and confirms the findings of Brown and Venkatesh (2005) that belief structures and socio-demographics should be employed holistically to maximise our understanding of the world around us. The issue is that even wealthy, well educated households may deride ICT for a variety of reasons, outside of household demography. By applying the TAM as we have we may now capture these effects so that differential adoption patterns, within cohorts of similar socio-demographic nature, can be observed. Several methodological considerations exist for this research. As discussed earlier, the representation of the sample frame to the UK was limited by the electoral register as it does not provide a database of all UK residents; thereby creating an automatic non-response bias (i.e. not everyone has the opportunity to respond to the survey). Although our data is weighted to UK national averages, we cannot reasonably assume that other unknown non-response biases are not present. Reassuringly, the London based data collection of Choudrie and Dwivedi (2005) estimates computer adoption within their sample to be of similar magnitude to our own (77.6%, our 2003 survey; 76.2%, Choudrie and Dwivedi 2003 survey). Given that these surveys were conducted only 3 months apart, but in two distinct geographic areas, we may have evidence of consistency between our sample frames and the generalisation of our results towards the nation as a whole, providing that it is weighted. On modelling matters, a limitation of the application of TAM into the econometric framework we provide is that it is not as richly specified as the MATH model of Venkatesh and Brown (2001). A natural extension to this paper would be to test our current framework but exchange TAM for the MATH.

The results of both the theoretical and statistical models offer a number of policy implications. For telecom planners who wish to launch new ICT-related products, successful marketing should target households with higher-than-average income and stronger educational backgrounds as this would maximize their return on investment. Importantly however, we have tested a theoretical model that suggests that even poorer, less well off households can have strong desire to adopt ICT but have little financial potential to do so. This discussion highlights a pent up demand in the market place that may be akin to market imbalance, if not failure. We would suggest that it is the role of government to reduce these imbalances. Importantly for government policy is the need to understand the determinants of the digital divide so that policies may be guided to limit their effect on society. It is clear from our analysis that ICT excluded groups tend to be poorer and less well-educated, but that the exclusion is potentially as finance-oriented (*involuntary non-adoption*) as technology perception based (*voluntary non-adoption*). This would imply that any policy that seeks to diminish the digital divide, as focussed around household computer technology, should focus on minimising income related effects but importantly also, on shifting the negative perceptions of those that do not already embrace ICT technologies.

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APPENDIX A

Lancaster University
MANAGEMENT SCHOOL

A snapshot of British attitudes towards technology in the home and workplace

Section 1: Computers and Internet Access at Home...

Q1 **Do you have a computer in your household?**

	Yes	No
Do you have a computer in your household?	☐	☐

Q2 **How many computers do you have in your household (please include laptop computers)?**

☐

Q3 **If you have more than one computer in your household, are any of them networked?**

☐ Yes ☐ I only have one computer
☐ No ☐ Don't Know

Q4 **Which type of network do you have at home?**

☐ Computers are connected by wires ☐ Computers are connected wirelessly (e.g. 802.11b)

Q5 **Do you ever use your computer at home to access the Internet?**

☐ Yes ☐ No

Q6 **How long have you had your Internet connection?**

☐ Less than 3 months ☐ 1 to 2 years
☐ 3 to 6 months ☐ 2 to 3 years
☐ 6 to 12 months ☐ More than 3 years

Q7 **Which of the following methods do you use most frequently to connect to the Internet at home?**

☐ 56k Modem ☐ Broadband
☐ Slower Modem ☐ Don't know
☐ ISDN

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Q8 **Which Internet Service Provider (ISP) do you subscribe to (example: Freeserve or AoL)? If you subscribe to more than one ISP please write down the one you use most frequently.**

☐

Q9 **How do you pay for your ISP?**

☐ Fixed monthly subscription fee and call charges ☐ Fixed monthly subscription fee but no call charges
☐ Fixed monthly subscription fee, call charges and some free call minutes ☐ Only call charges are paid (no monthly subscription fee)
☐ Your ISP is completely free of charge

Q10 **What is your current monthly subscription fee for your ISP? If you are not charged for this service please enter £0.**

☐

Q11 **Please tell us how you feel about your ISP by rating the following statements.**

	Strongly Disagree	Disagree	Neither Agree/Disagree	Agree	Strongly Agree
My ISP is excellent value for money	☐	☐	☐	☐	☐
My ISP's quality of service is excellent	☐	☐	☐	☐	☐

Q12 **How satisfied are you with your current Internet connection whe using it for the following purposes?**

	Don't know	Very unsatisfied	Unsatisfied	Satisfied	Very satisfied
Downloading web pages	☐	☐	☐	☐	☐
Sending email attachments	☐	☐	☐	☐	☐
Communicating with others (e.g. email)	☐	☐	☐	☐	☐
Downloading/viewing film trailers	☐	☐	☐	☐	☐
Downloading/listening to music	☐	☐	☐	☐	☐
Searching for information using serach engines	☐	☐	☐	☐	☐
Shopping online	☐	☐	☐	☐	☐
Downloading or sending photographic images	☐	☐	☐	☐	☐

Q13 **Have you ever heard of online telephony (e.g. Voice over IP, Skype)?**

☐ Yes ☐ No

Q14 **Do you use online telephony?**

☐ Yes ☐ No

Q15 **How long have you used online telephony?**

☐ Less than 1 month ☐ 7 to 12 months
☐ 1 to 3 months ☐ More than 1 year
☐ 4 to 6 months

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Q16 **Have you ever accessed the Internet at home by any of the following methods (you may select more than one option)?**

- ☐ Through your TV (e.g. Sky Digital or NTL)
- ☐ Mobile Telephone
- ☐ Personal Digital Assistant
- ☐ I access the Internet using a computer only
- ☐ I don't use the Internet at home at all

Other (please state)

Section 2: To be completed by all households who do not have broadband connections...
Your Opinion on Broadband...

Broadband provides you with an "always on" Internet connection that is much faster than a standard modem connection and you don't have to pay any call charges at all. An additional benefit of broadband is that you can also make phone calls whilst connected to the Internet. You can also download information much faster from the Internet when you are using broadband. Please answer the following questions...

Q17 **For all NON-BROADBAND users only, would you consider purchasing broadband within the following time periods?**

- ☐ 0 to 6 months
- ☐ 7 to 12 months
- ☐ 13 to 18 months
- ☐ I will purchase broadband but I don't know when
- ☐ Broadband is not available where I live
- ☐ I don't intend purchasing broadband in the future

Q18 **What would be the highest monthly subscription fee at which you would consider purchasing a broadband service?**

Q19 **Imagine that you have broadband at home, how satisfied do you think you would be when using the Internet for the following purposes?**

	Don't know	Very unsatisfied	Unsatisfied	Satisfied	Very satisfied
Downloading web pages	☐	☐	☐	☐	☐
Sending email attachments	☐	☐	☐	☐	☐
Communicating with others (e.g. email)	☐	☐	☐	☐	☐
Downloading/viewing film trailers	☐	☐	☐	☐	☐
Downloading/listening to music	☐	☐	☐	☐	☐
Searching for information using search engines	☐	☐	☐	☐	☐
Shopping online	☐	☐	☐	☐	☐
Downloading or sending photographic images	☐	☐	☐	☐	☐

Section 3: To be completed by all households who have broadband connections
Your Broadband Connection...

Q20 **How long have you had your broadband connection?**

- ☐ Less than 3 months
- ☐ 3 to 6 months
- ☐ 6 to 12 months
- ☐ 1 to 2 years
- ☐ 2 to 3 years
- ☐ More than 3 years

Q21 **For HOME BROADBAND users only, please select how your Internet service is delivered to your household.**

- ☐ Cable Modem (via Cable TV company)
- ☐ Satellite Broadband
- ☐ ADSL Modem (via telephone line)
- ☐ Wireless (e.g. BT Mobile, Orange 3G)
- ☐ Don't know

Q22 **For HOME BROADBAND users only, how fast is your Internet connection (example: 0.5Mb or 1Mb)?**

- ☐ 0.25Mb
- ☐ 0.5Mb
- ☐ 1Mb
- ☐ 2Mb to 4Mb
- ☐ More than 4Mb but less than 8Mb
- ☐ 8Mb or above

Q23 **For HOME BROADBAND users only, have you ever accessed the internet using a dial up modem?**

- ☐ Yes
- ☐ No

Q24 **For HOME BROADBAND users only, please tell us how you feel about your broadband Internet connection by rating the following statements.**

	Strongly Disagree	Disagree	Neither Agree/Disagree	Agree	Strongly Agree
Broadband offers much more than just a faster Internet connection	☐	☐	☐	☐	☐
Broadband has changed the way I view the Internet	☐	☐	☐	☐	☐
Broadband has changed the way I use the Internet	☐	☐	☐	☐	☐

Section 4: To be completed by all households
Technology and YOU...

Q25 **Do you have any of the following products at home?**

	Yes	No
Microwave oven	☐	☐
Video recorder/DVD Player	☐	☐
Video Camera/Digital Camera	☐	☐
Games console (e.g. Playstation, Xbox)	☐	☐
Electronic personal organiser	☐	☐
Answer machine	☐	☐
Mobile phone	☐	☐
Fax machine	☐	☐
Satellite dish/Cable TV/Freeview	☐	☐
CD player. MP3, minidisk or IPOD type player	☐	☐
Wide screen television (not plasma or panel)	☐	☐
Plasma television	☐	☐
Cinema or surround sound	☐	☐

Q26 **Please tell us how you rate the following statements.**

	Strongly Disagree	Disagree	Neither Agree/Disagree	Agree	Strongly Agree
I cannot afford a computer and Internet access	☐	☐	☐	☐	☐
I am confident in using a computer and the Internet	☐	☐	☐	☐	☐
I do not find computers and the Internet to be important	☐	☐	☐	☐	☐

Q27 **Please tell us how you feel about computers in general by rating the following statements.**

	Strongly Disagree	Disagree	Neither Agree/Disagree	Agree	Strongly Agree
I find that computers are easy to use	☐	☐	☐	☐	☐
I find that computers are useful	☐	☐	☐	☐	☐
I find that computers are enjoyable to use	☐	☐	☐	☐	☐

Q28 **Listed below are some uses of the Internet. Even if you do not use the Internet, please tell us how important you would find each use.**

	Not important	Important	Very important
Communication	☐	☐	☐
Online gaming	☐	☐	☐
Online gambling	☐	☐	☐
Downloading music	☐	☐	☐
Downloading film trailers	☐	☐	☐
Other entertainment	☐	☐	☐
Shopping	☐	☐	☐
Online banking and other financial services	☐	☐	☐
Education	☐	☐	☐
General information	☐	☐	☐
Business use	☐	☐	☐
Online telephone (e.g. voice over IP, Skype)	☐	☐	☐

Q29 **Please tell us how you feel about the Internet in general by rating the following statements.**

	Strongly Disagree	Disagree	Neither Agree e/Disagree	Agree	Strongly Agree
I find that the Internet is easy to use	☐	☐	☐	☐	☐
I find that the Internet is useful	☐	☐	☐	☐	☐
I find that the Internet is enjoyable to use	☐	☐	☐	☐	☐

Q30 **How often do you use the Internet at home for general surfing of the World Wide Web?**

- ☐ Everyday (7 days per week)
- ☐ Most Days (4 to 6 days per week)
- ☐ At least once a week (1 to 3 days per week)
- ☐ At least once a month (1 to 3 days per month)
- ☐ Several times a year (1 to 11 days per year)
- ☐ Never
- ☐ Don't Know

Q31 **How often do you use the Internet at home for accessing email?**

- ☐ Everyday (7 days per week)
- ☐ Most Days (4 to 6 days per week)
- ☐ At least once a week (1 to 3 days per week)
- ☐ At least once a month (1 to 3 days per month)
- ☐ Several times a year (1 to 11 days per year)
- ☐ Never
- ☐ Don't Know

Q32 **Recently, news reports have highlighted the risks of a type of fraud called 'phishing', whereby fraudsters tempt Internet users into declaring secure information such as online bank account details. Please answer the following questions on how this may have affected you.**

	Strongly Disagree	Disagree	Neither Agree e/Disagree	Agree	Strongly Agree
I have not heard of the term 'phishing' before	☐	☐	☐	☐	☐
'phishing' has not affected the way I use the Internet	☐	☐	☐	☐	☐

Q33 **Have you personally received email asking you for your online bank account details?**

☐ Yes ☐ No

Section 5: Please complete this section if you are currently in employment or a student.
Computers and the Internet in the Workplace and University/College...

Q34 **Do you have access to the Internet/email at work or university/college?**

☐ Yes ☐ No

Q35 **Are you allowed to use the Internet/email at work or university/college for personal use?**

☐ Yes ☐ No

Q36 **How often do you use the Internet/email at work or university/college for personal use?**

- ☐ Every day that I work/study
- ☐ More than half of the days that I work/study
- ☐ Less than half of the days that I work/study
- ☐ At least once a week
- ☐ Rarely
- ☐ Never
- ☐ Don't Know

Section 6: To be completed by all households. Shopping, the Internet and YOU...

Q37 **Have you ever used the Internet to buy products?**

☐ Yes ☐ No

Q38 **When did you *first* shop online?**

☐ Less than 3 months ☐ 1 to 2 years
☐ 3 to 6 months ☐ 2 to 3 years
☐ 6 to 12 months ☐ More than 3 years

Q39 **When did you *last* shop online?**

☐ Less than 3 months ☐ 1 to 2 years
☐ 3 to 6 months ☐ 2 to 3 years
☐ 6 to 12 months ☐ More than 3 years

Q40 **If you have used the Internet for shopping, which types of product did you buy? You may choose more than one option.**

	Yes	No
Groceries	☐	☐
Books	☐	☐
CD's, DVD's and videos	☐	☐
Travel arrangements (e.g. flights & holidays)	☐	☐
Entertainment (e.g. Cinema tickets, sport and concerts)	☐	☐
Personal effects (e.g. clothes, cosmetics, eye wear etc)	☐	☐
Computer hardware/software including games	☐	☐
TV, Hifi, video and photographic equipment	☐	☐
Financial and insurance services (e.g. online banking)	☐	☐
Childrens toys	☐	☐
Flowers	☐	☐
Household goods (e.g. washing machines & furniture)	☐	☐

Q41 **Have you ever been recommended a particular online shop by a friend or relative that you later puchased goods from?**

☐ Yes ☐ No

Q42 **If you have not used the Internet for shopping, have you used it to find information on products that you later bought in a shop?**

☐ Yes ☐ No

Q43 **Have you ever bought a product on the Internet that you previously looked at in a shop?**

☐ Yes ☐ No

Q44 **Please tell us how you feel about the Internet and shopping in general by rating the following statements *even if you have never used the Internet for shopping*.**

	Strongly Disagree	Disagree	Neither Agree/Disagree	Agree	Strongly Agree
I rarely use the Internet for shopping	☐	☐	☐	☐	☐
I only use the Internet to look for information on the products I intend to buy	☐	☐	☐	☐	☐
I buy products on the Internet only if I can buy at a cheaper price	☐	☐	☐	☐	☐
I would buy products on the Internet only if the products are produced or sold by a famous company	☐	☐	☐	☐	☐
Shopping on the Internet is becoming easier	☐	☐	☐	☐	☐
I would not buy online if the amount of money involved is large	☐	☐	☐	☐	☐

Q45 **In your opinion which of the following statements would best describe the way you buy products and the Internet?**

☐ The Internet has not changed the way I buy products
☐ The Internet has partly changed the way I buy products
☐ The Internet has definitely changed the way I buy products
☐ The Internet will change the way I buy products
☐ I do not intend to use the Internet to buy products

Q46 **Credit card companies and retailers have put a lot of effort to reduce fraud on the Internet. Please rate the following statements on fraud and shopping.**

	Strongly Disagree	Disagree	Neither Agree/Disagree	Agree	Strongly Agree
Paying bills on the Internet is safe	☐	☐	☐	☐	☐
Paying bills in shops is safe	☐	☐	☐	☐	☐
The Government has a role to play to reduce fraud on the Internet	☐	☐	☐	☐	☐

Q47 **How would you prefer to shop for the following types of product?**

	Always Internet	Always Shops	Both
Groceries	☐	☐	☐
Books	☐	☐	☐
CD's, DVD's and videos	☐	☐	☐
Travel arrangements (e.g. flights & holidays)	☐	☐	☐
Entertainment (e.g. Cinema tickets, sport and concerts)	☐	☐	☐
Personal effects (e.g. clothes, cosmetics, eye wear etc)	☐	☐	☐
Computer hardware/software including games	☐	☐	☐
TV, Hifi, video and photographic equipment	☐	☐	☐
Financial and insurance services (e.g. online banking)	☐	☐	☐
Childrens toys	☐	☐	☐
Flowers	☐	☐	☐
Household goods (e.g. washing machines & furniture)	☐	☐	☐

Q48 **Have you ever used any television shopping channels (e.g. QVC, Price drop TV) to purchase goods?**

☐ Yes ☐ No

Q49 **Are the stores and shops that you use easy to access from where you live?**

☐ Yes ☐ No

Q50 **Does the location of the stores and shops influence your decision to shop online?**

☐ Yes ☐ No

Q51 **Please tell us how you feel about the convenience aspects of shopping by rating the following statements.**

	Strongly Disagree	Disagree	Neither Agree/Disagree	Agree	Strongly Agree
Internet shopping is very convenient	☐	☐	☐	☐	☐
Going to the shops is a convenient way of buying products	☐	☐	☐	☐	☐
Going to the shops is as convenient as Internet shopping	☐	☐	☐	☐	☐
Internet shopping is only convenient for certain types of products	☐	☐	☐	☐	☐
Internet shopping is risky	☐	☐	☐	☐	☐
Going to the shops is only convenient for certain types of products	☐	☐	☐	☐	☐
Internet shopping is only risky for certain products	☐	☐	☐	☐	☐

Section 7: To be completed by everyone. Information about your household...

Please complete the following questions as best as you feel you can. Please be assured that the personal information

Q52 **How many adults (aged 16 and above) live in your household?**

☐

Q53 **How many children under the age of 16 live in your household?**

☐

Q54 **What is the highest academic qualification that anyone in your household has obtained?**

- ☐ University degree or above, or NVQ level 4 or equivalent
- ☐ Professional Institutes Final exam/Higher National Certificate/Teachers Training Certificate
- ☐ GCE 'A' Level, NVQ level 3, advanced GNVQ or equivalent e.g Professional Institutes intermediate exam/SRN full industrial apprenticeship/HND
- ☐ GCE 'O' Level / GCSE / CSE/Secretarial Diploma / Ordinary National Degree/NVQ level 2 or equivalent
- ☐ Other qualifications
- ☐ No academic qualifications
- ☐ Don't know

Q55 **What is the approximate annual income of your household, after deducting income tax, national insurance, pension schemes and so on?**

- ☐ Under £10,000
- ☐ £10,000 to £14,999
- ☐ £15,000 to £19,999
- ☐ £20,000 to £24,999
- ☐ £25,000 to £29,999
- ☐ £30,000 to £39,999
- ☐ £40,000 to £49,999
- ☐ £50,000 to £59,999
- ☐ £60,000 to £79,999
- ☐ £80,000 or more

Questions about you...

Q56 **Are you...?**

☐ Male ☐ Female

Q57 **What is your age group?**

- ☐ 18 to 24
- ☐ 25 to 29
- ☐ 30 to 34
- ☐ 35 to 39
- ☐ 40 to 44
- ☐ 45 to 49
- ☐ 50 to 54
- ☐ 55 or older

Q58 **Which of the following best describes your current marital status?**

- ☐ Single
- ☐ Cohabiting
- ☐ Married
- ☐ Widowed
- ☐ Divorced
- ☐ Separated

Q59 **Which of the following best describes your status within your household?**

- ☐ Head of household
- ☐ Direct family member (e.g. husband, wife, son or daughter)
- ☐ Living with relatives
- ☐ Shared house (non-family)

Q60 **What is your highest academic qualification?**

- ☐ University degree or above, or NVQ level 4 or equivalent
- ☐ Professional Institutes Final exam/Higher National Certificate/Teachers Training Certificate
- ☐ GCE 'A' Level, NVQ level 3, advanced GNVQ or equivalent e.g Professional Institutes intermediate exam/SRN full industrial apprenticeship/HND
- ☐ GCE 'O' Level / GCSE / CSE/Secretarial Diploma / Ordinary National Degree/NVQ level 2 or equivalent
- ☐ Other qualifications
- ☐ No academic qualifications
- ☐ Don't know

Q61 **Which of the following best describes your current employment status?**

- ☐ Full-time employment
- ☐ Part-time employment
- ☐ Homemaker
- ☐ Student
- ☐ Between Jobs
- ☐ Permanently unemployed
- ☐ Retired

Q62 **If employed, which of the following best describes your current occupation?**

- ☐ Senior management
- ☐ Junior management
- ☐ Professional
- ☐ Office/clerical worker
- ☐ Manual worker
- ☐ Public sector
- ☐ Armed forces
- ☐ Other employment/Self employed

Q63 **What is your approximate annual income after deducting income tax, national insurance, pension schemes and so on?**

- ☐ Under £7,500
- ☐ £7,500 to £11,249
- ☐ £11,250 to £14,999
- ☐ £15,000 to £18,749
- ☐ £18,750 to £22,499
- ☐ £22,500 to £26,249
- ☐ £26,250 to £29,999
- ☐ £30,000 to £33,749
- ☐ £33,750 to £37,499
- ☐ £37,500 to £44,999
- ☐ £45,000 or more

Q64 **Do you own a debit/credit card?**

- ☐ Yes
- ☐ No

Q65 **Would you be interested in taking part in future surveys so that changes in the way that people use technologies in the UK may be monitored?**

- ☐ Yes
- ☐ No

Thank you for completing the survey, we are very grateful. If any of the details we have used to contact you are incorrect please update them using the spaces provided below and then return the survey to us using the prepaid envelope.

Q66 **Your name including title**

Q67 **House Name or Number**

Q68 **First line of address**

Q69 **Second line of address**

Q70 **Town/City**

Q71 **Postcode**

Q72 **Your contact telephone number**

Best wishes,

Alastair and Didier

On behalf of Lancaster University Management School

Q73 **Our Ref (if applicable)**